



Department of Energy

**Ohio Field Office
Fernald Area Office**

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1709

SEP 16 1998

**Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911**

DOE-1204-98

**Kenneth Multerer, Acting Supervisor
U.S. Department of the Interior
Fish and Wildlife Service
Ecological Services
6930 Americana Parkway, Suite H
Reynoldsburg, OH 43068-4132**

Dear Mr. Schneider and Mr. Multerer:

**TRANSMITTAL OF RESPONSES TO OHIO ENVIRONMENTAL PROTECTION AGENCY AND
U.S. DEPARTMENT OF THE INTERIOR COMMENTS AND CHANGE PAGES TO THE DRAFT
FINAL NATURAL RESOURCE IMPACT ASSESSMENT AND NATURAL RESOURCE
RESTORATION PLAN**

Enclosed please find responses to the Ohio Environmental Protection Agency (OEPA) and U.S. Department of the Interior (DOI) comments on the Natural Resource Impact Assessment (NRIA) and the Natural Resource Restoration Plan (NRRP). Change page inserts have also been provided based on comment responses. The NRRP will be revised before the September 21, 1998, public availability period.

If you have any questions or require additional information, please contact Kathleen Nickel at (513) 648-3166, or Pete Yerace at (513) 648-3161.

Sincerely,

**Johnny W. Reising
Fernald Remedial Action
Project Manager**

FEMP:Nickel

Enclosure

Mr. Schneider
Mr. Multerer

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SEP 16 1998

cc w/enclosure:

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TABLE 2-4
PADDYS RUN MACROINVERTEBRATE DATA COMPARISON

1709

| Station | Study | | | | | | |
|--|--------------------------------------|---------------------------------------|--|--|---|--|---|
| | Pomeroy July 1977 ^a | Facemire June 1986 ^b | Facemire Mar./June 1987 ^b | RI/FS May/June 1989 ^c | RI/FS Nov./Dec. 1989 ^c | RI/FS Mar./May 1990 ^c | RI/FS June/Aug. 1990 ^c |
| SHANNON DIVERSITY^d | | | | | | | |
| PR1 | | 3.2 | 0.97 | | | | |
| PR2 | 1.39 | 2.06 | | 2.29 | 3.24 | 3.5 | 3.3 |
| PR3 | | 2.4 | 0.43 | 2.54 | 2.43 | 2.99 | 2.81 |
| PR4 | | 1.9 | | | | | |
| PR5 | | 1.69 | 0.21 | 1.06 | 1.06 | 3.01 | 3.11 |
| PR6 | | 2.68 | | 0.55 | 1.04 | 3.31 | no data |
| PR7 | | 2.02 | | | | | |
| PR8 | | 1.8 | | | | | |
| PR9 | | 2.63 | | 1.43 | NA | 3.33 | no data |
| PR10 | | 1.96 | | | | | |
| PR11 | | | 0.66 | | | | |
| SIMPSON DIVERSITY^e | | | | | | | |
| PR1 | 0.4 | 0.844 | 0.744 | | | | |
| PR2 | | 0.653 | | 0.75 | 0.86 | 0.88 | 0.87 |
| PR3 | | 0.677 | 0.114 | 0.77 | 0.77 | 0.81 | 0.8 |
| PR4 | | 0.591 | | | | | |
| PR5 | | 0.599 | 0.043 | 0.28 | 0.31 | 0.8 | 0.85 |
| PR6 | | 0.777 | | 0.15 | 0.36 | 0.87 | no data |
| PR7 | | 0.6 | | | | | |
| PR8 | | 0.474 | | | | | |
| PR9 | | 0.794 | | 0.5 | NA | 0.85 | no data |
| PR10 | | 0.623 | | | | | |
| PR11 | | | 0.156 | | | | |

TABLE 2-4
PADDYS RUN MACROINVERTEBRATE DATA COMPARISON
(Cont'd)

| Station | Study | | | | | | |
|--------------------------------------|--------------------------------------|---------------------------------------|--|--|---|--|---|
| | Pomeroy July 1977 ^a | Facemire June 1986 ^b | Facemire Mar./June 1987 ^b | RI/FS May/June 1989 ^c | RI/FS Nov./Dec. 1989 ^c | RI/FS Mar./May 1990 ^c | RI/FS June/Aug. 1990 ^c |
| SIMPSON DOMINANCE^e | | | | | | | |
| PR1 | 0.6 | 0.156 | 0.256 | | | | |
| PR2 | | 0.347 | | 0.25 | 0.14 | 0.12 | 0.13 |
| PR3 | | 0.323 | 0.886 | 0.23 | 0.22 | 0.19 | 0.2 |
| PR4 | | 0.409 | | | | | |
| PR5 | | 0.401 | 0.956 | 0.71 | 0.69 | 0.2 | 0.15 |
| PR6 | | 0.222 | | 0.84 | 0.64 | 0.13 | no data |
| PR7 | | 0.399 | | | | | |
| PR8 | | 0.526 | | | | | |
| PR9 | | 0.206 | | 0.5 | NA | 0.15 | no data |
| PR10 | | 0.377 | | | | | |
| PR11 | | | 0.844 | | | | |
| PIELOU'S EVENESS^f | | | | | | | |
| PR1 | 0.37 | 0.741 | 0.218 | | | | |
| PR2 | | 0.484 | | 0.82 | 0.8 | 0.81 | 0.79 |
| PR3 | | 0.556 | 0.114 | 0.8 | 0.73 | 0.66 | 0.72 |
| PR4 | | 0.499 | | | | | |
| PR5 | | 0.729 | 0.062 | 0.33 | 0.35 | 0.7 | 0.79 |
| PR6 | | 0.725 | | 0.24 | 0.52 | 0.75 | no data |
| PR7 | | 0.583 | | | | | |
| PR8 | | 0.431 | | | | | |
| PR9 | | 0.76 | | 0.55 | NA | 0.77 | no data |

TABLE 2-4
PADDYS RUN MACROINVERTEBRATE DATA COMPARISON
(Cont'd)

1709

| Station | Study | | | | | | |
|----------------|--------------------------------------|---------------------------------------|--|--|---|--|---|
| | Pomeroy July 1977 ^a | Facemire June 1986 ^b | Facemire Mar./June 1987 ^b | RI/FS May/June 1989 ^c | RI/FS Nov./Dec. 1989 ^c | RI/FS Mar./May 1990 ^c | RI/FS June/Aug. 1990 ^c |
| DENSITY | | | | | | | |
| PR1 | | 2939.5 | 4846.1 | | | | |
| PR2 | 4339.16 | 5023.5 | | 100 | 240 | 568.9 | 577.2 |
| PR3 | | 5184.7 | 9077.6 | 151.1 | 184.4 | 773.3 | 586.7 |
| PR4 | | 3391.7 | | | | | |
| PR5 | | 55.1 | 6138.6 | 173.3 | 217.8 | 457.8 | 542.2 |
| PR6 | | 623.3 | | 295.6 | 33.3 | 557.8 | no data |
| PR7 | | 308.1 | | | | | |
| PR8 | | 4158 | | | | | |
| PR9 | | 351.1 | | 162.2 | 2.2 | 955.6 | no data |
| PR10 | | 330.1 | | | | | |
| PR11 | | | 9163.1 | | | | |

^a Pomeroy 1977

^b Facemire *et al.* 1990

^c DOE 1992a

^d Shannon Diversity was calculated as follows:

$$H' = \frac{[(N \log N - \sum ni \log ni) * 3.321928]}{N}$$

Where:

N = the total density of all families collected

3.321928 = conversion to log base 2

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TABLE 2-4
PADDYS RUN MACROINVERTEBRATE DATA COMPARISON
(Cont'd)

In order to calculate Simpson Diversity (D_s) community dominance is initially calculated as follows:

$$L = \frac{\sum n_i(n_i - 1)}{N(N - 1)}$$

then:

$$D_s = 1 - L$$

Pielou's Evenness is calculated as follows:

$$J' = \frac{H'}{H'_{\max}}$$

Where:

H' = Shannon diversity

H'_{\max} = log (number of families)

TABLE 2-5
AVIAN SPECIES DATA COMPARISON

1709

| Species ^a | Occurrence ^f | Insectivorous (I) or Foliage Gleaning (FG) ^g | Study Dates | | | |
|------------------------------|-------------------------|---|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | | | Summer 1977 ^b | Summer 1986 ^c | Winter 1986 ^d | Spring 1987 ^e |
| Blue-winged Warbler | C | I and FG | | | | x |
| Northern Parula Warbler | U | I and FG | | | | |
| Yellow Warbler | C | I and FG | | x | | |
| Cerulean Warbler | C | I and FG | | | | |
| Yellow-rumped Warbler | U | I and FG | | | | x |
| Black-throated Green Warbler | C | I and FG | | | | x |
| Yellow-throated Warbler | U | I and FG | | | | |
| Blackpoll Warbler | R | I and FG | | | | x |
| Prairie Warbler | U | I and FG | | | | |
| Ovenbird | U | | | | | |
| Louisiana Waterthrush | C | I | | x | | |
| Northern Waterthrush | R | I | | | | x |
| Kentucky Warbler | C | I | | | | |
| Mourning Warbler | R | I | | | | x |
| Common Yellowthroat | C | I and FG | x | x | | |
| Yellow-breasted Chat | C | I and FG | x | x | | |
| Hooded Warbler | R | I and FG | | | | |
| American Redstart | U | I and FG | | | | x |
| House Sparrow | A | | x | x | x | |
| Eastern Meadowlark | A | | x | x | x | |
| Red-winged Blackbird | A | | x | x | x | |
| Common Grackle | A | | x | x | | |
| Brown-headed Cowbird | C | | x | x | | |
| Orchard Oriole | U | I and FG | x | x | | |
| Northern Oriole | C | I and FG | | x | | |
| Scarlet Tanager | U | I and FG | x | x | | |
| Summer Tanager | U | I and FG | | x | | |
| Cardinal | A | | x | x | x | |
| Rose-breasted Grosbeak | U | | | x | | x |

TABLE 2-5
AVIAN SPECIES DATA COMPARISON
(Cont'd)

| Species ^a | Occurrence ^f | Insectivorous (I) or Foliage Gleaning (FG) ^g | Study Dates | | | | |
|------------------------|-------------------------|---|-----------------------------|-----------------------------|-----------------------------|-----------------------------|----|
| | | | Summer 1977 ^b | Summer 1986 ^c | Winter 1986 ^d | Spring 1987 ^e | |
| Indigo Bunting | A | | x | x | | | 1 |
| Evening Grosbeak | I | | | | | | 2 |
| Purple Finch | U | | | | | | 3 |
| Pine Siskin | I | | | | | | 4 |
| American Goldfinch | A | | x | x | x | | 5 |
| Red Crossbill | I | | | | | | 6 |
| Rufous-sided Towhee | C | | x | x | x | | 7 |
| Savannah Sparrow | U | | x | x | | | 8 |
| Grasshopper Sparrow | U | | x | x | | | 9 |
| Henslow's Sparrow | R | | | | | | 10 |
| Dark-eyed Junco | A | | | | x | | 11 |
| Tree Sparrow | U | | | | x | | 12 |
| Chipping Sparrow | C | | | x | | | 13 |
| Field Sparrow | A | | x | x | | | 14 |
| White-crowned Sparrow | U | | | | | | 15 |
| White-throated Sparrow | A | | | | x | | 16 |
| Fox Sparrow | R | | | | | | 17 |
| Swamp Sparrow | U | | | | | x | 18 |
| Song Sparrow | C | | x | x | x | | 19 |
| Great blue heron | U | | | x | | | 20 |
| Green Heron | C | | x | x | | | 21 |
| Canada Goose | C | | | | | | 22 |
| Mallard | C | | | x | | | 23 |
| Black Duck | C | | | | | | 24 |
| Wood Duck | C | | | x | | | 25 |
| Common Goldeneye | U | | | | | | 26 |
| Oldsquaw | R | | | | | | 27 |
| Turkey Vulture | C | | | x | | | 28 |
| Black Vulture | R | | | | | | 29 |

TABLE 2-5
AVIAN SPECIES DATA COMPARISON
(Cont'd)

1709

| Species ^a | Occurrence ^f | Insectivorous (I) or Foliage Gleaning (FG) ^g | Study Dates | | | | |
|----------------------|-------------------------|---|-----------------------------|-----------------------------|-----------------------------|-----------------------------|----|
| | | | Summer 1977 ^b | Summer 1986 ^c | Winter 1986 ^d | Spring 1987 ^e | |
| Sharp-shinned Hawk | R | | | | | | 1 |
| Cooper's Hawk | U | | | x | x | | 2 |
| Red-tailed Hawk | C | | x | x | x | | 3 |
| Red-shouldered Hawk | U | | | | x | | 4 |
| Broad-winged Hawk | U | | | | | | 5 |
| Rough-legged Hawk | R | | | | | | 6 |
| Marsh Hawk | U | | | x | | | 7 |
| American Kestrel | C | | | x | x | | 8 |
| Bobwhite | C | | x | x | x | | 9 |
| Killdeer | C | I | x | x | x | | 10 |
| American Woodcock | U | | | x | | | 11 |
| Spotted Sandpiper | C | | | x | | | 12 |
| Solitary Sandpiper | U | | | x | | x | 13 |
| Herring Gull | C | | | | | | 14 |
| Ring-billed Gull | U | | | | | | 15 |
| Rock Dove | A | | | x | | | 16 |
| Mourning Dove | A | | x | x | x | | 17 |
| Yellow-billed Cuckoo | C | I and FG | x | x | | | 18 |
| Black-billed Cuckoo | U | I and FG | | x | | | 19 |
| Barn Owl | R | | | | | | 20 |
| Screech Owl | C | | | x | x | | 21 |
| Great Horned Owl | C | | | x | x | | 22 |
| Snowy Owl | I | | | | | | 23 |
| Barred Owl | C | | | | | | 24 |
| Long-eared Owl | R | | | | | | 25 |
| Short-eared Owl | R | | | | | | 26 |
| Saw-whet Owl | U | | | | | | 27 |
| Common Nighthawk | C | I | x | | | | 28 |
| Chimney Swift | A | I | x | x | | | 29 |

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TABLE 2-5
AVIAN SPECIES DATA COMPARISON
(Cont'd)

| Species ^a | Occurrence ^f | Insectivorous (I) or Foliage Gleaning (FG) ^g | Study Dates | | | | |
|---------------------------|-------------------------|---|-----------------------------|-----------------------------|-----------------------------|-----------------------------|----|
| | | | Summer 1977 ^b | Summer 1986 ^c | Winter 1986 ^d | Spring 1987 ^e | |
| Belted Kingfisher | C | | x | x | x | | 1 |
| Ruby-throated Hummingbird | C | I | | x | | | 2 |
| Common Flicker | C | I | x | x | x | | 3 |
| Pileated Woodpecker | U | I | | x | x | | 4 |
| Red-bellied Woodpecker | C | I | x | x | x | | 5 |
| Red-headed Woodpecker | R | I | | x | | | 6 |
| Yellow-bellied Sapsucker | U | I | | | | | 7 |
| Hairy Woodpecker | U | I | | x | x | | 8 |
| Downy Woodpecker | A | I | x | x | x | | 9 |
| Eastern Kingbird | U | I | | x | | | 10 |
| Great Crested Flycatcher | C | I | | x | | | 11 |
| Eastern Phoebe | C | I | | x | | | 12 |
| Willow Flycatcher | | I | | x | | | 13 |
| Arcadian Flycatcher | C | I | | x | | | 14 |
| Alder Flycatcher | U | I | | | | | 15 |
| Eastern wood Pewee | C | I | x | x | | | 16 |
| Horned Lark | U | I | | | | | 17 |
| Bank Swallow | U | I | | | | | 18 |
| Rough-winged Swallow | U | I | x | x | | | 19 |
| Barn Swallow | C | I | x | x | | | 20 |
| Purple Martin | C | I | | x | | | 21 |
| Blue Jay | A | | x | x | x | | 22 |
| Common Crow | A | | x | x | x | | 23 |
| Carolina Chickadee | A | I and FG | x | x | x | | 24 |
| Tufted Titmouse | A | I and FG | x | x | x | | 25 |
| White-breasted Nuthatch | C | I | | x | x | | 26 |
| Red-breasted Nuthatch | R | I | | | | | 27 |
| Brown Creeper | U | I | | | x | | 28 |
| House Wren | C | I | | x | | | 29 |

TABLE 2-5
AVIAN SPECIES DATA COMPARISON
(Cont'd)

1709

| Species ^a | Occurrence ^f | Insectivorous (I) or Foliage Gleaning (FG) ^g | Study Dates | | | |
|-------------------------|-------------------------|---|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | | | Summer 1977 ^b | Summer 1986 ^c | Winter 1986 ^d | Spring 1987 ^e |
| Winter Wren | R | I | | | | |
| Carolina Wren | C | I | | x | x | |
| Mockingbird | C | I | x | x | x | |
| Gray Catbird | C | I | x | x | | |
| Brown Thrasher | C | I | | x | | |
| American Robin | A | | x | x | x | |
| Wood Thrush | C | I | x | x | | |
| Eastern Bluebird | U | I | | x | x | |
| Blue-gray Gnatcatcher | C | I and FG | x | x | | |
| Golden-crowned Kinglet | C | I and FG | | | x | |
| Ruby-crowned Kinglet | U | I and FG | | | | |
| Cedar Waxwing | U | | | x | | |
| Loggerhead Shrike | R | | | | | |
| Starling | A | | x | x | x | |
| White-eyed Vireo | C | I and FG | | x | | |
| Yellow-throated Vireo | U | I and FG | | | | |
| Solitary Vireo | U | I and FG | | | | x |
| Red-eyed Vireo | A | I and FG | x | x | | |
| Philadelphia Vireo | R | I and FG | | x | | |
| Warbling Vireo | U | I and FG | | x | | |
| Prothonotary Warbler | R | I and FG | | | | |
| Black-and-white Warbler | C | I | | x | | |
| Tennessee Warbler | C | I and FG | | x | | x |
| Worm-eating Warbler | R | | | | | |

^a Species list derived from CNC (1978) and includes birds which regularly nest within the area and those expected during the winter months. The list also includes several unexpected species observed during one or more of the studies.

^b Observed June 27 - 28, 1977 (Pomeroy *et al.* 1977).

^c Observed June 25 - July 25, 1986 (Facemire *et al.* 1990).

^d Observed December 5, 1986 - March 6, 1987 (Facemire *et al.* 1990).

^e Observed April - May 1987 (Facemire *et al.* 1990).

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TABLE 2-5
AVIAN SPECIES DATA COMPARISON
(Cont'd)

^f Abbreviations:

A = Abundant (may be seen more than 75% of the time in the proper habitat and at the right time of the year)

C = Common (may be seen more than 50% of the time)

U = Uncommon (may be seen between 10% and 50% of the time)

R = Rare (may be seen 10% or less of the time)

I = Irregular (occur in varying numbers from year to year, and in some years may not appear at all) (CNC 1978)

^g ~~Insectivorous species depend on insects for food. Foliage gleaning species obtain food off of plant foliage.~~

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TABLE 2-6
ECO-RISK DATA FOR SOUTH PINES AND WASTE UNITS

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| | Soil | Drinking Water | Benchmark Toxicity Value |
|-----------|------|-------------------|--------------------------|
| Antimony | 29.5 | - | 10 ^b |
| Cadmium | 5.8 | - | 5 ^b |
| Silver | 10.3 | - | 10 ^b |
| Aluminum | - | 1830 ^a | 87 ^a |
| Beryllium | - | 66 ^a | 4 ^a |

^a Concentrations in $\mu\text{g/L}$

^b Concentrations in mg/kg

TABLE 2-7
ECO-RISK DATA FOR NORTH PINES AND WOODLOTS

| | Soil - Woodlot ^a | Drinking Water - Woodlot ^b | Soil ^a - Pines | Benchmark |
|----------------------|-----------------------------|--|---------------------------|--------------------------------------|
| Cadmium | 5.90 | 6.30 | - | 5 ^{cd} |
| Molybdenum | 11.7 | - | 12.4 | 10 ^c |
| Zinc | 707 | - | - | 500 ^c |
| Benzo(a)anthracene | 2.10 | - | - | 1 ^c |
| Benzo(b)fluoranthene | 2.10 | - | - | 1 ^c |
| Chrysene | 2.10 | - | - | 1 ^c |
| Aluminum | - | 232 | 10,700 | 10,103 ^c /87 ^d |
| Mercury | - | 0.6 | - | 0.2 ^d |
| Uranium | - | 944 | - | 890 ^d |
| Manganese | - | - | 1530 | 1500 ^c |
| Benzo(a)pyrene | 1.60 | - | - | 1 ^c |

^a Concentrations in mg/kg

^b Concentrations in mg/l

^c Soils (mg/kg)

^d Terrestrial Organisms (μg/l)

TABLE 2-8
ECO-RISK DATA FOR GRASSLANDS

1709

| | Soil | Drinking Water | Off-Property Soil | Benchmark Toxicity Value |
|------------------------|--------|-------------------|-------------------|--------------------------------------|
| Aluminum | 25,700 | 1830 ^a | - | 10,103 ^b /87 ^c |
| Antimony | 21.5 | - | - | 10 ^b |
| Lead | 2180 | - | 1150 | 200 ^b |
| Manganese | 2100 | - | 3420 | 1500 ^b |
| Molybdenum | 14.5 | - | - | 10 ^b |
| Uranium | 3620 | - | - | 230 ^b |
| Benzo(g,h,i)perylene | 3.10 | - | - | 1 ^b |
| Benzo(a)pyrene | 1.15 | - | - | 1 ^b |
| Benzo(b)fluoranthene | 3.70 | - | - | 1 ^b |
| Benzo(k)fluoranthene | 3.30 | - | - | 1 ^b |
| Chrysene | 3.20 | - | - | 1 ^b |
| Dibenzo(a,h)anthracene | 1.10 | - | - | 0.088 ^b |
| Indeno(1,2,3)pyrene | 3.0 | - | - | 1 ^b |
| Beryllium | - | 66 ^a | - | 4 ^c |

^a Addressed with the south pines and waste units

^b Soils (mg/kg)

^c Terrestrial Organisms (μg/l)

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LIST OF ACRONYMS

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|----------|---|
| BTV | benchmark toxicity value |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| DOE | U.S. Department of Energy |
| DOE-FEMP | U.S. Department of Energy, Fernald Field Office |
| EPA | United States Environmental Protection Agency |
| FCAB | Fernald Citizens Advisory Board |
| FEMP | Fernald Environmental Management Project |
| FRL | final remediation level |
| HEA | Habitat Equivalency Analysis |
| IEMP | Integrated Environmental Monitoring Plan |
| IRDP | Integrated Remedial Design Package |
| NEPA | National Environmental Policy Act |
| NRDA | Natural Resource Damage Assessment |
| NRIA | Natural Resource Impact Assessment |
| NRRDP | Natural Resource Restoration Design Plan |
| NRRP | Natural Resource Restoration Plan |
| NRTs | Natural Resource Trustees |
| ODNR | Ohio Department of Natural Resources |
| OEPA | Ohio Environmental Protection Agency |
| OSDF | On-Site Disposal Facility |
| pls | pure live seed |
| PRCRP | Paddys Run Conceptual Restoration Plan |
| RI/FS | Remedial Investigation/Feasibility Study |
| ROD | Record of Decision |
| SCS | Soil Conservation Service |
| SEP | Sitewide Excavation Plan |
| TSS | total suspended solids |
| USFWS | U.S. Fish and Wildlife Service |

The purpose of the NRIA is to establish a "baseline" level of impact from which appropriate restoration activities can be developed. The NRIA was designed to function in a manner analogous to an Injury Determination in the formal Natural Resource Damage Assessment (NRDA) process (43 CFR 11). Since the intent of the NRTs is to pursue a more streamlined evaluation and assessment process and not to conduct a formal NRDA, the NRIA and NRRP were designed to meet the substantive aspects of the formal NRDA process to the extent practicable.

The level of impacts identified in the NRIA was used to assess a required level of natural resource restoration as presented in the NRRP. Habitat Equivalency Analysis (HEA), described in Section 1.4 and Addendum B was used to determine the amount of restoration required to compensate for impacts to terrestrial habitats. The Fernald NRTs have negotiated other projects to compensate for groundwater impacts as discussed in Section 1.5 of this plan. The results of the HEA and NRT negotiations were used to establish the restoration activities outlined in Section 4.0 of this plan. The NRIA and NRRP will be approved as a final document with no further revisions. However, the progress of restoration at the FEMP will be tracked by the NRTs to ensure proper implementation of the NRRP.

Implementation of the NRRP will facilitate a resolution of DOE's natural resource damage liability. Any liability settlement documentation among the NRTs will include re-opener provisions in the event of an unanticipated release and subsequent injuries to natural resources.

1.4 SUMMARY OF HABITAT EQUIVALENCY ANALYSIS

The HEA process was utilized to ensure that the level of natural resource restoration outlined in this NRRP is commensurate with the level of impact identified in the NRIA (Addendum B). HEA methodology provides a means of compensating for natural resource injury through the calculation of habitat restoration acreage. By linking estimates of service loss over time to service gains through restoration projects, potentially contentious dollar damage estimates may be avoided.

From the information presented in the NRIA, conservative assumptions and qualitative judgements were used to develop the HEA calculations. This streamlined process allowed for an "order of magnitude" justification for on-property restoration. Also, as described in Section 1.5, HEA was used to calculate terrestrial and surface water habitats only.

1.5 APPROACH FOR GROUNDWATER

The HEA process is appropriate for estimating restoration acreage when injuries are associated with ecological functions and habitat loss. Service losses to humans, such as contamination of a drinking water supply, cannot easily be equated to habitat restoration. Restoration activities must be conducted to replace, restore, or acquire the equivalent of the injured natural resource. Therefore, it is very difficult to compensate for groundwater impacts through ecological restoration.

02 The Great Miami Aquifer is a major focus of remediation activities at the FEMP. As discussions regarding compensation for groundwater impacts have progressed, the FEMP NRTs have recognized that many actions have been taken to date. The Operable Unit 5 Record of Decision (OU5 ROD) (DOE 1996) committed DOE to pump and treat contaminated groundwater in order to reach the 20 µg/l total uranium FRL. Originally, this effort called for the installation of 28 extraction wells pumping at a combined rate of 4,000 gpm for approximately 27 years. An enhanced groundwater remedy was approved as part of the Baseline Remedial Strategy Report. This approach called for the installation of additional extraction wells and the use of groundwater re-injection technology. By implementing this revised strategy, the time to complete groundwater remediation could be shortened by as much as 17 years. Groundwater extraction actually started before the OU5 ROD was finalized, with the implementation of the OU5 South Plume Removal Action.

In addition to groundwater remediation activities, DOE has undertaken several other efforts to address groundwater contamination. An alternate water supply was provided to several local industries as part of the South Plume Removal Action. Also, in the late 1980s, DOE began providing bottled water to local residents potentially effected by uranium-contaminated groundwater. This program was discontinued when a public water supply was installed in the Fernald area in 1996, which DOE partially funded.

Given the different groundwater remediation activities that were agreed to/underway, the FEMP NRTs tried to agree on an appropriate compensation for groundwater impacts. Because the FEMP NRTs originally agreed to focus on habitat restoration as compensation for all impacts, an attempt was made to calculate restoration acreage due to groundwater impact. Several scenarios for using HEA were proposed, but the NRTs were not satisfied that justification was adequate. As a result, the FEMP NRTs agreed to abandon the use of HEA for groundwater compensation. Instead, the NRTs agreed to

ensure that all on-property areas are ecologically restored [minus the On-Site Disposal Facility (OSDF) and the 23 acres of land under consideration for potential economic development by the Community Reuse Organization (CRO)]. This would protect a portion of the Paddys Run watershed, which contributes to the recharge of the Great Miami Aquifer. In addition, DOE agreed to develop a groundwater education module, which may be either permanently displayed at the FEMP or made available to area schools. By implementation of these projects, and by completion of remedial activities, the FEMP NRTs agreed that DOE would adequately compensate for injuries to groundwater.

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2.0 RESTORATION PLANNING

The ecological restoration projects proposed in this NRRP have been developed by considering the extent of excavation and grading and the sequence of remediation activities so that restoration and establishment of the future land use can be expedited. In addition, consideration was given to uncertainties and a variety of other regulatory and technical considerations. This section will provide the basis for the proposed ecological restoration projects and conceptual final land use outlined in this plan.

2.1 ECOLOGICAL RESTORATION GOALS

Ecological restoration goals form the foundation from which conceptual restoration planning decisions are made. They also provide the basis for monitoring to determine the progress of restoration. The ecological restoration goals are stated and described below.

2.1.1 Restoration of Native Vegetation

Goal: *Enhance, restore, and construct, as feasible given postexcavation landforms and soils, vegetative communities native to presettlement southwestern Ohio.*

Ecological restoration at the FEMP will be conducted to promote the native flora of southwestern Ohio. This primarily involves the restoration of contiguous tracts of upland and riparian forest, interspersed with open water and/or wetland systems. Section 3.0 provides a more detailed description of habitat types which existed at the FEMP prior to industrial and agricultural development. The intent of this restoration plan is to use the natural dynamics of ecological systems to the extent possible. For example, to convert an introduced grassland to an upland forest, an early and mid-successional tree mix will be emphasized rather than focusing on late successional or climax species. Native species would be used in excavated areas, since they are naturally suited for colonizing disturbed soils. Where existing forest is to be enhanced, shade-tolerant species may be planted to take advantage of the existing forest canopy. The vegetative species mix will depend on many factors, including soil, elevation, slope, drainage, adjacent existing vegetation, cost, and availability.

2.1.2 Paddys Run Restoration

Goal: *Enhance, restore, and reconstruct the natural dynamic stream characteristics and aquatic systems of Paddys Run, as necessary and feasible.*

Just as most other streams in southwestern Ohio, Paddys Run has been significantly altered due to channeling, erosion control, and removal of sand and gravel. In most instances, existing development prevents the restoration of a natural stream function. However, since undeveloped land is available at the FEMP, the potential exists to restore Paddys Run floodplain and subsequent natural stream habitat. Section 3.1.4 provides additional information regarding Paddys Run stream restoration.

2.1.3 Wildlife Promotion

Goal: *Enhance, restore, and construct ecological systems that promote the habitation of wildlife populations native to southwestern Ohio.*

03 ~~Wildlife will not be introduced into any particular habitat.~~ Wildlife use will be considered when selecting flora. Wildlife structures and cover (i.e., bird boxes, brush piles) may be included in ecological restoration designs.

2.1.4 Meet Mitigation Requirements

Goal: *Integrate all regulatory mitigation requirements into natural resource restoration plans.*

DOE is required to mitigate certain impacts to natural resources through laws and regulations. These include commitments under the National Environmental Policy Act (NEPA) and wetland mitigation under Section 404 of the Clean Water Act. To the extent possible, these actions will be conducted on-property and combined with adjacent restoration projects to allow for the contiguous restoration of the FEMP. Similar constraints as outlined in Section 2.1.1 must be taken into consideration during design and implementation.

2.2 INTEGRATION WITH SITEWIDE EXCAVATION PLAN

The sequencing of the implementation of the restoration projects proposed in this plan will be coordinated with the timing and sequencing of soil excavation. In addition, the final restoration of the site will be a function of the extent of excavation and final grading required during soil remediation.

This section addresses how implementation of the projects outlined in the NRRP will be integrated with the guidelines established in the SEP and its appendices.

The planting of vegetation will include species native to the existing and/or nearby counties. Standard vegetation literature and local site descriptions will be used as the basis for selections of plant species and plant community cover types.

Types of wildlife features such as species of birds, mammals, reptiles, amphibians and their associated habitat requirements will be specified as needed. To the extent possible, herbaceous and woody plant species will be selected and specified based on their ability to provide food or cover for selected wildlife species.

Standard erosion control practices will be employed during wetland construction. To the extent possible, natural materials (coconut logs, coconut fiber matting) will be used to control erosion as part of the planting specifications. All sedimentation and erosion control measures will be consistent with the stormwater pollution prevention program.

4.3 AREA 8, PHASE II REVEGETATION

This demonstration project involves the creation of native forest cover in the grazed pasture located in the northwestern corner of the FEMP, west of Paddys Run (Figure 4-3). The purpose of this project is to provide an area of finished reforestation early in the overall restoration process that will effectively demonstrate to the public the feasibility and advantages of restoring natural habitats. The demonstration forest will provide upland and riparian habitat, and provide ecotones for many forms of wildlife. ~~In addition, the flood storage capacity of Paddys Run may be increased.~~ The grazing lease in this area will be terminated, as part of the continued phase-out of grazing lease agreements at the FEMP.

4.3.1 Functional Objectives for Area 8, Phase II Revegetation

This forested area will be one of the first to be revegetated and will serve as a demonstration project for reforestation. The functional objective is to expand a native ecosystem within southwest Ohio, provide habitat, serve as a buffer, ~~increase Paddys Run floodplain,~~ and provide aesthetic appeal. This project will consist of two forest types, upland and riparian forest. The upland forest would be located along a portion of the north property boundary and the west property boundary, extending southward to the rail spur. The riparian forest would extend along the existing riparian corridor of the west bank

of Paddys Run from the northern property line southward to the rail spur. This project will be part of the required restoration for impacts to the Paddys Run Corridor. It will consist of approximately 20 acres of restored vegetative community. If feasible, flood storage capacity will be increased along Paddys Run, in the form of lowered bank elevations and/or the creation of wetland habitat.

4.3.2 Design Considerations for Area 8, Phase II Revegetation

The upland and riparian forest will be planted in a random patch design toward the goal of a target density of vegetation within a specified area. The target density will be typical of the local area. This methodology will be implemented within other restoration project areas where applicable.

The upland forest will be typical of a midwestern upland successional forest, consisting of a canopy and shrub layer by randomly planting hardwood trees and shrubs. Within Area 8, Phase II, a large number of native trees already exist. The NRRDP will take this existing vegetation into consideration when designing the planting plan for Area 8, Phase II.

The riparian forest will be typical of a plant community found in somewhat poorly drained soils, consisting of a canopy and shrub layer of plant materials which have root systems that are tolerant of prolonged moisture. Sections 3.2.1 and 3.2.2 provide characteristics of upland and riparian forest.

Wetland creation/restoration may also be integrated into the riparian forest design, as described in Section 3.2.4. This approach would be consistent with the Paddys Run Conceptual Restoration Plan, which is detailed in Section 3.1.4.

A phase-out of grazing lease agreements has been negotiated with the lessee. This schedule calls for the cessation of grazing in Area 8, Phase II in 1999. The lease for Area 1, Phase III will be terminated in 2001. For Area 8, Phase III, grazing will continue until 2002.

4.4 AREA 2, PHASE I REVEGETATION

The remediation of Area 2, Phase I will result in a significant change in the topography of this area. The current Inactive Flyash Pile and Active Flyash Pile will be removed, causing in a decrease of the existing elevation. Because this area is adjacent to Paddys Run, the proposed restoration would involve revegetating remediated areas in a manner that will expand the riparian corridor along Paddys Run and incorporate provisions of the long term management plan for Paddys Run. The sediment ponds that are

currently proposed for use during remediation may be relined to control sediment loading to Paddys Run (Figure 4-4).

A portion of this project will constitute the required restoration for impacts to the Southern Pines and waste units. The completed project will encompass approximately 20 acres of restored vegetative community. The remediation of Area 2, Phase I is expected to be completed in the year 2000. Therefore, revegetation efforts will be targeted for implementation in the Spring of 2001. However, coordination with several other projects may delay implementation for several years. For instance, the existing sediment basins may be left in place for several years until future uses can be decided.

4.4.1 Functional Objectives for Area 2, Phase I Revegetation

The functional objectives for Area 2, Phase I are to incorporate Paddys Run Stream restoration, if necessary, and to expand the riparian corridor. Enhancement of the riparian corridor would provide a native vegetative community, terrestrial wildlife habitat, increased water quality, and reduced erosion. In low-order streams such as Paddys Run, riparian vegetation provides shading that reduces water temperature, discourages eutrophication, and provides organic material in the form of detritus, which is important for the health of the stream.

Pursuant to the long-term management plan for Paddys Run, restoration of Area 2, Phase I could serve to increase the Paddys Run floodplain, thereby absorbing surface water flow stress during typical storm events. If feasible, the lower elevation areas of Area 2, Phase I, such as the sediment basins, could be converted into floodplain habitat, with water tolerant plant species that can withstand periods of inundation.

Higher elevation areas will be restored to an upland forest and tied into existing adjacent vegetation.

07 This effort will ~~not~~ meet the ecological restoration goals of restoring native vegetative communities and promoting wildlife habitat.

4.4.2 Design Considerations for Area 2, Phase I Revegetation

Lower elevations of A2PI will be restored to riparian forest. Since most of Area 2, Phase I will be excavated, topsoiling or some other amendment may be necessary. An additional consideration involves securing access to a series of groundwater injection and extraction wells that will be installed as part of the Aquifer Restoration Project. Also, plans may be revised if the South Field contingency borrow area is needed. The NRRDP will include the specific requirements for addressing restoration of the contingency borrow area. Until a final decision is made, Area 2, Phase I will be seeded with native grasses pursuant to the guidelines set forth in Appendix F of the SEP (DOE 1998). Revegetation of upland and riparian areas will be conducted pursuant to Section 3.2.1 and 3.2.2.

4.5 ENHANCEMENT OF EXPANDED AREA 1, PHASE I WOODLOTS

This restoration project involves the enhancement of the Northern Pine Plantation by interplanting deciduous trees and shrubs among thinned pines (Figure 4-5). The existing stand of deciduous trees in the northern portion of Area 1 would remain unchanged. Deciduous planting sites would be formed within the blocks of white pines (*Pinus strobus*) by girdling and/or removing individual pines, while the Austrian pine (*Pinus nigra*) would be cleared. Upland forest species will be interplanted among the pines. Non-native and/or invasive vegetation (e.g., multiflora rose, honeysuckle spp., wild grape) will be controlled pursuant to the invasive species management plan. In addition, openings will be made to diversify habitat and allow brush piles and snags to be created in the Area 1, Phase I woodlots. Openings will be enhanced with brush piles using cut trees.

Some areas of the Area 1, Phase I woodlots will be subjected to construction activity and related impacts since the area is adjacent to the OSDF. Therefore, the near-term activities discussed above will improve the survival of the remaining stand of trees. This project, in part, will constitute the required restoration for impacts to the northern woodlots. The completed project will encompass approximately 49 acres of restored vegetative community.

4.5.1 Functional Objectives for Expanded Area 1, Phase I Woodlots

The functional objectives are the establishment of deciduous forest communities and to provide wildlife habitat. Forest communities will be established by interplanting the pine plantation into an upland forest association, and will transition into the existing upland forest to the north. Plant species selected

for planting among the pines will be typical of gently sloping areas with deep, rich, mesic soils. Plant species selected for the transition portion will be typical of drier slopes and ridges.

Wildlife habitat will be provided for interior forest species upon maturation. Prior to maturation of the proposed forest communities, the mosaic of existing forest cover combined with patched plantings of herbaceous vegetation and tree seedlings will provide good habitat for edge-dwelling forest wildlife.

4.5.2 Design Considerations for Expanded Area 1, Phase I Woodlots

The interplanting of upland forest into the pine plantation will require selective thinning of the existing rows of white pines and clearing of the Austrian pines to promote pine canopy openings for the planting of hardwoods. After the pines have been cleared and thinned, the openings in the northern portion of the area will be enhanced with upland forest plantings that promote transition to the existing deciduous woodlot. In the middle and southern portions of Area 1, thinned and cleared rows of pines would also be enhanced with upland forest plantings typical of mesic soils. Trees and shrubs more tolerant of filtered shade would be planted in areas where dense stands of pines will be left. Follow-up observations will be made regarding survival of planted vegetation. If survival rates are low, then additional white pines would be selectively thinned as necessary to allow more sunlight and new seedlings of the same species would be planted. Section 3.2.1 provides more detail regarding upland revegetation. The Area 1, Phase I woodlots will be enhanced after remedial action certification for the area is complete in 1998 as funding becomes available.

4.6 ENHANCEMENT AND MANAGEMENT OF AREA 1, PHASE III WOODLOT/WETLAND MITIGATION PHASE II

This restoration project involves the enhancement and expansion of a large woodland, which will provide habitat diversity (Figure 4-6). The improvements to the Area 1, Phase III woodlot will be implemented in the following sequence. First, the grazing lease will be terminated, as part of the continued phase-out of grazing lease agreements at the FEMP. The lessee will be notified of the schedule for lease termination. Areas west of Paddys Run will be available for grazing for one year after the termination.

A comprehensive revegetation program will be implemented in Spring 2002 and involve the connection of fragmented woodlots with native deciduous tree species. Most of the upland areas already support

deciduous forest. The existing forest cover will be preserved, with the larger gaps being filled by planting tree seedlings as necessary and allowing natural succession to proceed toward climax forest. In addition, an invasive plant species management program will be implemented as described in Section 3.1.7.

A portion of this project, will constitute the required restoration for impacts to the northern woodlots. Part of this project will contribute to the required restoration of the grasslands and the Great Miami River. Once completed, the restored Area 1, Phase III will encompass approximately 100 acres of restored vegetative communities.

As stated in Section 3.2.4, DOE agreed to mitigate wetlands at a 1.5 to 1 ratio, replacing 1.5 acres of wetlands for every one acre dredged or filled. DOE also agreed to implement the mitigation on property if possible. To meet those two commitments, DOE has proposed the expansion of the northern forested wetland (Area 1, Phase III), if feasible (Figure 4-7). The 1996 watershed study indicated that some wetland expansion is possible, contributing to a portion of the required wetland mitigation, upon agreement by the agencies. DOE will initiate the design process for expansion of the northern forested wetland as part of on-property wetland mitigation with the goal of field implementation by Spring 2003.

Wetland mitigation in Area 1, Phase III can only be implemented after the area is certified, and the entire area must be certified to accommodate drainage of the watershed into the wetlands. Certification scheduling of Area 1, Phase III will need to be accelerated to accommodate wetland mitigation.

4.6.1 Functional Objectives for Area 1, Phase III Woodlot/Wetland Mitigation Phase II

Expansion of existing successional forest will meet the goals of restoring native vegetative communities and promoting wildlife habitat. The enhanced forest cover will provide a significant block of closed canopy native forest to provide suitable habitat for interior forest dwelling wildlife.

The functional objectives for wetland mitigation are to contribute toward meeting the mitigation ratio and to provide wildlife habitat. The wetland mitigation ratio of 1.5:1 will be met if 15 acres of somewhat poorly drained soils can be formed within Area 1, Phase III. The temporary presence of a haul road through this area will reduce the amount of acreage available for near-term wetland

mitigation. Upon removal of this haul road, more acreage would be available in this area for future implementation of wetland mitigation.

The proposed area for wetland mitigation is located south and adjacent to the Northern Woodlot which contains a contiguous and diverse mosaic of forest cover which provides good habitat for forest-interior dwelling wildlife. Wetland mitigation performed south of the Northern Woodlot may consist of a palustrine forested, broad-leaved deciduous wetland, which would provide additional habitat for interior forest dwelling species.

4.6.2 Design Considerations for Area 1, Phase III Woodlot/Wetland Mitigation Phase II

The termination of grazing is required to facilitate the progress of natural succession. Gaps in forest cover will be identified and planted using upland tree and shrub seedlings. Considerations will be given to specific conditions, such as soil moisture and existing vegetation, when selecting trees and shrub species. Section 3.2.1 provides more detail regarding upland forest revegetation.

Existing areas of hardwood forest would be inspected for shrub development. In areas with little or no shrub development under the tree canopy, typical upland shrubs could be randomly planted. These shrubs are capable of growing in filtered shade. An invasive plant species management plan (Section 3.1.7) will be implemented to ensure survival of planted vegetation.

Soils in the existing wetlands are mapped in the Ragsdale and Fincastle soil series and soils in the proposed wetland mitigation area are mapped in the Fincastle and Xenia soil series (SCS 1982a). The Ragsdale, Fincastle, and Xenia soils represent a catena of soil series that are of similar mineralogy but have different drainage classifications. The Ragsdale series consists of very poorly drained soils typically found in depressional areas and shallow basins. The Fincastle series consists of somewhat poorly drained soils, often in intermediate landscape positions between Ragsdale and Xenia soils. The Xenia series consists of moderately well drained soils, often found upslope of Fincastle soils. A detailed analysis of the soil and hydrological conditions in this area would be required to determine the suitability of wetland formation.

The successful establishment of wetland soils will involve ensuring the bottom of the wetland area contains impermeable material. Most of the proposed area for wetland mitigation is mapped as

containing Fincastle soils with 0-2 percent slopes, which indicates these soils experience brief seasonal periods of poor drainage. The conversion of areas containing Fincastle soils may only require shallow surface excavation (4-6 inches) or it may be possible to form wetland conditions by compacting the soils without excavating. Liners could also be utilized as determined appropriate. During excavation, silt fences would be established to separate the mitigation area from existing wetlands to prevent sediment deposition into the new wetlands until vegetation is established. Soil from the A-horizon will be stockpiled on nearby uplands to topsoil the new wetlands after excavation is complete. It may be necessary to overexcavate by 4-6 inches to provide adequate volume for topsoil.

Topsoiling involves the manipulation of the surface soil following excavation to form a suitable medium for plant establishment. In natural soils, the upper soil layer (A-horizon) is typically comprised of a surface layer of friable, loamy, dark colored soil underlain by a layer of similar material which is light yellow or orange. The A-horizon is generally 8-12 inches deep in both Fincastle and Xenia soils. Underlying the A-horizon is the B-horizon, which is mineral soil that is more dense and of greater concentration of aluminum and iron.

The best source of available topsoil for this wetland mitigation project would be from the stripped topsoil of the wetland mitigation area, if this soil is certified as clean. Such topsoil would contain a bank of native wetland plant propagules (seeds and rhizome fragments), along with native mycorrhizal fungi, which are symbiotic soil fungi essential to the growth of many plants. If necessary, the applied stockpile soil will be inoculated with mycorrhizal fungi to ensure successful plant growth response. Although the propagule bank will be derived from uplands, many of the plants typical of low lying uplands are also typical of seasonally saturated wetlands. Propagules capable of establishment in the wetlands will survive while the others will perish. If the common reed (*Phragmites australis*), an invasive weed of wetlands and low-lying areas, is present in the stripped topsoil, then off-site sources, such as nurseries, may have to be considered for topsoil.

The mitigated wetlands will initially support woody seedlings amid a cover of emergent herbs typical of wet meadows. Revegetation will involve stabilizing the exposed wetland soils with a seed mix of native wetland grasses, sedges, and forbs, followed by the planting of woody wetland tree and shrub seedlings. The species composition of the herbaceous layer will change over time due to natural succession and will eventually be shaded out by the growth of trees and shrubs.

A dense herbaceous cover would be rapidly established to prevent erosion of exposed soils and sedimentation from existing wetlands. A seed mix consisting of species which are indigenous to wet meadow habitats and provide value to wildlife would be intermixed and broadcast. The seed mix would consist of rice cutgrass (*Leersia oryzoides*), prairie cordgrass (*Spartina pectinata*), woolgrass (*Scirpus cyperinus*), softstem bulrush (*Scirpus validus*), rattlesnake mannagrass (*Glyceria canadensis*), lake sedge (*Carex lacustris*), and redtop (*Brunnichia cirrhosa*). This seed mix is commercially available and is recognized for establishing a dense cover within a moderate time frame. Woody tree and shrub species would then be randomly planted with the intent to establish forest cover. These species would be typical of seasonally saturated wetland forests and well drained riparian uplands.

4.7 RE-ESTABLISHMENT OF THE CORRIDOR EAST OF PADDYS RUN

The corridor east of Paddys Run is located in Area 2, Phase II (Figure 4-9). The Paddys Run riparian corridor will be restored pursuant to the long term management plan for Paddys Run, as described in Section 2.3.4. The appropriate amount of floodplain will be established along Paddys Run to account for a one-year storm event. Excavated areas will be utilized to the extent possible. Additional grading and clearing of existing vegetation may be necessary to establish the required floodplain. Once floodplain elevations are established, revegetation would be conducted pursuant to the guidelines established in Sections 3.2.1 and 3.2.2.

The Southern Pine Plantation will be converted into an upland forest by clearing of the Austrian pines and thinning the white pines to promote pine canopy openings for the planting of hardwoods, as outlined in Section 4.5.2.

4.7.1 Functional Objectives for the Corridor East of Paddys Run

Restoration of floodplain and expansion of the riparian corridor meets the Paddys Run restoration and native vegetation goals established in Section 2.1. By expanding the floodplain of Paddys Run, erosional stress is relieved on existing cut banks and natural meander patterns would develop. These meanders increase pool and riffle habitat within Paddys Run, thereby increasing habitat quality for aquatic species.

Floodplain revegetation will promote habitats typical of southwest Ohio. This meets the secondary goal of enhancing wildlife habitat, as a contiguous corridor will be established along the length of Paddys Run.

This project will compensate for impacts to the Paddys Run corridor and the Great Miami Aquifer. Restoration of the Paddys Run corridor will result in protection of an important recharge area for the Great Miami Aquifer. Once completed, the ecological restoration of the corridor east of Paddys Run will encompass approximately 77 acres of restored vegetative communities.

4.7.2 Design Considerations for the Corridor East of Paddys Run

The area of floodplain required will be determined through the investigations described in Section 2.3.4. Floodplain establishment must be coordinated with planned excavations to the extent possible.

The restoration design will seek to minimize earth moving, but some regrading will be required. These efforts will be coordinated with excavation and certification activities. It may be necessary for some areas to remain in interim restoration status until adjacent excavation areas are available for final restoration. In these situations the area would be graded and seeded for interim restoration pursuant to the guidelines established in the SEP. Excavated areas that are to be revegetated may require the addition of topsoil or some other amendment to increase organic matter in the existing soil. Soil amendments will be minimized, since periodic flooding will provide organic matter into the soil. Also, the vegetation to be established will consist of pioneer species that naturally root in poor soils. The specific plant species used will also be tolerant of periodic inundation. Section 3.2.2 provides further detail regarding the selection of plant species for floodplain areas. In areas outside of floodplain a separate upland forest would be established in accordance with Section 3.2.1.

4.8 EXPANSION OF THE CORRIDOR WEST OF PADDYS RUN

Expansion of the corridor west of Paddys Run will occur in Area 8 (Figure 4-10). This project is similar in scope to the eastern corridor expansion described above, with the exception of a few additional considerations. Area 8 is a perimeter area addressed under Appendix E in the SEP, and no excavation is expected. Any expansion of floodplain west of Paddys Run would require extensive regrading. Also, portions of Area 8 will be utilized for other activities. In Area 8, Phase I, several

environmental projects will be conducted. Just north of Area 8, Phase I is Area 8, Phase III, where prehistoric Native American remains may be reinterred as the result of an agreement with several Native American Tribes and organizations. The coordination of these activities into ecological restoration planning is described in more detail below.

4.8.1 Functional Objectives for the Corridor West of Paddys Run

The functional objectives for this project are similar to those for the corridor east of Paddys Run. In addition, the design will integrate the components of the environmental projects and the Native American reburial into the overall restoration.

4.8.2 Design Considerations for the Corridor West of Paddys Run

The floodplain and revegetation considerations for the western corridor are similar to those for the eastern corridor. Since the environmental projects involve the establishment of native vegetation communities, adjacent revegetation efforts will not require major modification. For the Native American reburial area, the restoration is conceptually planned as a tallgrass savanna. The Native American groups have indicated a preference for this type of habitat, with no development. Therefore, revegetation of this area will be conducted in accordance with Section 3.2.3. Adjacent upland forest revegetation will be modified to transition into the tallgrass savanna.

4.9 AREA 1, PHASE II BORROW AREA AND AREA 2, PHASE III

Excavation of the Area 1, Phase II borrow area will be used to form a wetland system, with upgradient areas revegetated as a tallgrass prairie transitioning through a tallgrass savanna to an upland forest (Figure 4-11). Area 2, Phase III restoration will involve the expansion of upland forest to the border of the potential economic development area (Figure 4-11).

4.9.1 Functional Objectives for Area 1, Phase II Borrow Area and Area 2, Phase III

This restoration project will meet ecological restoration goals by restoring native vegetative communities and protecting wildlife habitat. Wildlife habitat will be provided by establishing a variety of ecosystems and edge habitat. Wetland construction may also be used to partially fulfill regulatory wetland mitigation requirements. This restoration project will provide compensation for impacts to grasslands. Once completed, the restoration of Area 1, Phase II and Area 2, Phase III will encompass approximately 139 acres of restored vegetative communities.

4.9.2 Design Considerations for Area 1, Phase II Borrow Area and Area 2, Phase III

All habitats will be restored pursuant to the guidelines in Section 3.0 for the wetlands/open water, uplands, and tallgrass prairie/savanna. Restoration grading must be designed to maximize the collection of water from upgradient areas. The extent of wetland to be constructed will depend on the amount of available surface water drainage. Soils and hydrology will be assessed as part of wetland design.

Wetlands generally require gradual shoreline slopes of 6:1 or flatter to a depth of 1 to 3 feet. The vegetation of seasonally inundated wetlands would consist of vegetation typical of pond edge habitats and tolerant of regular to permanent inundation up to 1 foot. Shallow open water areas would consist of nonpersistent and noninvasive plant species which are indigenous to southwestern Ohio in shallow open waters 3 feet in depth. These plant species include a mixture of species that produce submerged growth, emergent growth, and floating leaves which will maximize habitat diversity. Seedlings of floating and submerged species could be planted in equal proportions on approximately 3-foot centers in each open water area.

Possible impacts due to increased human activity must be taken into consideration during revegetation design of boundary areas, including the 23-acre potential economic development area. A selection of hardy, tolerant tree species may be planted along the edges. All revegetation efforts will be conducted pursuant to Sections 3.2.1 and 3.2.3.

4.10 FORMER PRODUCTION AREA RESTORATION

Restoration of the Former Production Area will utilize the postexcavation topography to establish a series of open water/wetland systems surrounded by tallgrass prairie. A transition to upland forest and connection with the expanded riparian corridor will occur in the west portion of the Former Production Area (Figure 1-1).

4.10.1 Functional Objectives for Former Production Area Restoration

The plan for restoring the Former Production Area depends on the postexcavation condition of the area. After remedial activities have been completed, the Former Production Area will consist of several deep excavations and areas of exposed subsoil (Figure 2-1). The postexcavation topography could be converted to open water and/or wetland habitat to meet the goal of providing wildlife habitat.

This approach will minimize the amount of backfill and regrading, resulting in a considerable cost savings. Prairie revegetation will stabilize the exposed soil.

Restoration of the Former Production Area will compensate for impacts to grassland and the Great Miami Aquifer. Since this area contributes to the Paddys Run watershed, restoration activities will provide protection of an aquifer recharge zone. Once completed, the restored Former Production Area will encompass approximately 197 acres of restored wildlife habitat.

4.10.2 Design Considerations for Former Production Area Restoration

This project involves formation of wetlands and possibly open waters and as such will require an assessment to determine the type of aquatic habitats. A water availability study has been conducted and is presented in Addendum C. This study shows that the formation of open water and/or wetlands is feasible. However, further investigation will be required once detailed design is initiated. Also, soil types will be assessed to characterize the soil profile underlying the proposed final grade. The properties of these soils will be examined to support the design of a topsoil and soil amendment program. Specific sources of suitable topsoil or other amendments will be identified before the design is finalized.

The final grade will be required to simulate the natural conditions necessary to form the tallgrass prairie-wet meadow complex. Standards for the reclamation of coal strip mines include restoring the mine headwall (the upper slope separating the mine from intact upland soils) to a slope not exceeding 3:1, and other slopes within the mine to less than 5:1. The Former Production and Waste Pit areas may be more representative of conditions requiring a 5:1 slope. The 5:1 slope would represent an upper limit on steepness, with an emphasis on the formation of gently undulating topography where possible. Gentler slopes will facilitate revegetation, reduce the likelihood of gully erosion, and be more compatible with the surrounding landscape. The finished grade would direct surface runoff into distinct subwatersheds, which ultimately would drain into Paddys Run. The lowest lands of each subwatershed would contain a sequence of shallow depressions connected by a channel. The downstream end of each depression will be slightly bermed to induce wetland conditions. Linear swales will be formed to allow runoff within the swales to naturally carve the channels.

Areas surrounding open water would be restored primarily to a tallgrass prairie. The tallgrass prairie may consist of a seed mix which contains Indian grass, big bluestem, little bluestem, side-oats gramma, and switchgrass. The seed mix would contain 2 pounds (lbs) per acre pure live seed (pls) Indian grass, 2 lbs/acre pls big bluestem, 1 lb/acre pls little bluestem, 1 lb/acre pls side-oats gramma, and 0.5 lb/acre switchgrass (Holtzman1997).

If hydrological conditions permit, certain depressions may contain a transition from shallow open water to seasonally inundated wetlands. The vegetation of seasonally inundated wetlands would consist of vegetation typical of pond edge habitats and tolerant of regular to permanent inundation up to 1 foot.

Nonpersistent plant species selected would be noninvasive plant species which are indigenous to southwestern Ohio in shallow open waters 3 feet in depth. These plant species include a mixture of species that produce submerged growth, emergent growth, and floating leaves which will maximize habitat diversity.

The tallgrass prairie and upland forest restoration will be conducted in accordance with Sections 3.2.1 and 3.2.3. Although prairie grasses and forbs are suited for the poor soil conditions after excavation, additional amendments may be needed to optimize growth. On-site research as part of the Environmental Projects will provide further information as to the type of amendment providing optimal plant growth.

Portions of the Former Production Area may undergo interim restoration, since the area consists of several excavation areas. If interim restoration is required, it will be conducted in accordance with the SEP.

4.11 WASTE STORAGE AREA RESTORATION

The Waste Storage Area will be restored similar to the corridor east of Paddys Run (Section 4.7). The results of the Paddys Run floodplain modeling will determine the extent of riparian habitat that will be established. The riparian habitat will transition into an upland forest.

4.11.1 Functional Objectives for Waste Storage Area Restoration

The function objectives for the Waste Storage Restoration Area are similar to those established for the corridor east of Paddys Run listed in Section 4.7.1. Floodplain restoration will meet the goals of native vegetation, Paddys Run Restoration, and Wildlife Habitat. Once completed, the restoration of the Waste Storage Area will encompass approximately 72 acres of restored vegetative communities.

4.11.2 Design Considerations for Waste Storage Area Restoration

Design consideration for the Waste Storage Restoration Area are similar to those established for the corridor east of Paddys Run listed in Section 4.7.2.

4.12 OSDF PERIMETER RESTORATION

The public has requested that a permanent buffer be established around the OSDF to lessen visual impact of the facility. The buffer will be established with appropriate topography and vegetation to function as a wooded corridor. Other possible features of this project include establishing areas of native grasses and providing nest boxes for wildlife species. This project will compensate for the required restoration for impacts to grasslands. Once completed, the OSDF buffer will encompass approximately 110 acres of wildlife habitat.

4.12.1 Functional Objectives for OSDF Perimeter Restoration

The functional objectives are to provide visual screening, edge habitat, and aesthetic appeal. The OSDF visual buffer will lessen the visual impact of the OSDF to the surrounding landscape. This buffer will not be able to completely obscure the 50-foot plus high relief which will comprise the OSDF, but the buffer will appear as a natural dense strip of woody vegetation which will soften the appearance of the mound. Selection of plant material will emphasize the use of evergreens and native deciduous trees.

4.12.2 Design Considerations for the OSDF Perimeter Restoration

Typical upland tree species will be those described in Section 3.2.1. The barrier must accommodate for OSDF stormwater drainage, monitoring wells, and access. These items will be considered during detailed design.

04 4.13 GREAT MIAMI AQUIFER RESTORATION

The Great Miami Aquifer is a sole-source aquifer that supplied water to thousands of individuals in the vicinity of the FEMP. The Great Miami Aquifer is a significant natural resource, and the FEMP NRTs must ensure that impacts to it are addressed through restoration or some other form of compensation. As discussed in Section 1.0, it is recognized that DOE has already conducted a number of restoration activities. The CERCLA remedy involves a large-scale groundwater pump and treat effort requiring the installation and operation of extraction and injection wells. In addition, DOE provided \$6.4 million to install a public water supply for residents near the FEMP. It is also recognized that CERCLA remediation and ecological restoration of the FEMP will protect an important groundwater recharge area for the Great Miami Aquifer. While taking these activities into consideration, the FEMP NRTs have agreed on an appropriate level of additional compensation for impacts to the Great Miami Aquifer, which is discussed below.

4.13.1 Functional Objectives for Great Miami Aquifer Restoration

The functional objectives for Great Miami Aquifer restoration involve the assurance by DOE that areas of the FEMP that constitute recharge zones for the Great Miami Aquifer will be ecologically restored and the commitment to create a groundwater education module for the local community. The FEMP NRTs have agreed that these actions, in conjunction with the remediation activities already planned or underway, will adequately compensate for natural resource impacts to the Great Miami Aquifer.

4.13.2 Design Considerations for Great Miami Aquifer Restoration

The commitment to ecological restoration of the FEMP has been woven into the NRRP. All of the specific ecological restoration projects described in Section 4.0 of the NRRP contribute in some way to the protection of groundwater recharge areas. The current FEMP property would be ecologically restored through implementation of all the projects described except for the land required for the OSDF and the 23-acre CRO economic development area. The FEMP NRTs have made it clear that if some ecological restoration projects are not implemented, then additional compensation for groundwater impacts would be sought.

The groundwater education effort will probably involve several interrelated components that benefit schools and the local community. A permanent display may be installed at or near the FEMP, which addresses the value of the Great Miami Aquifer as a natural resource and describes the history of

remediation activities at the FEMP. This display would be accompanied by various education materials developed for different grade levels and for the local community. Education materials may be integrated with current FEMP education programs, including groundwater education modules through the Partnership in Education program. FEMP NRTs will provide input into the production of groundwater education components.

4.134 RESTORATION PROJECT SCHEDULES

The schedules outlined in Table 4-1 have been developed to accomplish restoration as soon as practical after remediation. The dates provided are not intended to be enforceable milestones, but rather target dates that will be dependent upon the completion of remediation commitments. Changes in the completion of remediation for these areas may cause adjustments in design submittals and project implementation which will be addressed as necessary in each NRRDP.

5.0 MONITORING

Monitoring will be implemented to assess the progress of each restoration project. Monitoring will be performed using appropriate methods, measurements, and observations for each ecosystem identified within individual NRRDPs. Monitoring programs will be designed to identify the progress of restoration within each ecological community. Typically, standard vegetative measurement techniques will be used for monitoring (i.e., percent survival, percent cover, species diversity). Quantitative measurements may not be necessary to measure changes over time. Monitoring reports will be generated for each restoration area. These will include a collection of data, notes on field observations, and photographs. ~~The project-specific monitoring to be conducted and the interpretations of results will be coordinated with the NRTs.~~

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6.0 STAKEHOLDER INVOLVEMENT

Stakeholder involvement will be essential to successful development and implementation of this restoration plan. All meeting summaries generated from Natural Resource Trustee Meetings are made available to the public. ~~Starting in June of 1998, DOE will initiate a series of workshops with interested stakeholders regarding the concept for final land use as outlined in this NRRP. DOE-FEMP will issue this plan for a formal public review in August of 1998. Furthermore, a workshop will be held by all of the NRTs in August of 1998, to discuss the NRRP and the proposed settlement of Natural Resource issues at the FEMP in greater detail. Only after the public has been fully involved, will DOE pursue formal settlement with the other NRTs.~~ Stakeholders will have several opportunities to provide input. On September 21, 1998, the NRRP and the final land use Environmental Assessment will be made available to the public for a 30-day review and comment period. On September 23, 1998, the FEMP NRTs will conduct a public workshop to discuss the NRRP and the proposed settlement of natural resource trusteeship issues. A separate DOE-sponsored public hearing on final land use will be held at the October 13, 1998 Cleanup Progress Briefing. A fact sheet explaining the relationship of final land use, the FEMP NRTs, and the NRRP will be made available to the public on September 8, 1998. Only after the public has been fully involved will DOE pursue formal settlement with the other NRTs.

7.0 INSTITUTIONAL CONTROLS AND FUTURE LAND USE

Institutional controls are established in the Operable Unit 5 selected remedy as a means of ensuring continued protection of human and ecological receptors. These include:

- Continued access controls at the site during the remediation period
- Alternate water supplies to affected residential and industrial wells
- Continued federal ownership of the FEMP property
- Deed restrictions necessary to preclude residential and agricultural uses only and ensure recreational use of the remaining areas of the FEMP property
- Application of conservation easements for habitat restoration
- Enhancement of off-property areas, and the possible purchase of additional property adjacent to the FEMP.

Additionally, proper notifications, as mandated by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), will be provided before the transfer of any federal real property known to contain, or used in the processing of, hazardous substances. These measures will minimize the potential for human exposure to contaminated soil and groundwater during the implementation of sitewide remedial actions, and to the contaminated material contained in the OSDF following completion of remedial activities at the site. Specific institutional control measures will be established during the remedial design and remedial action processes. This section will be expanded as detailed design of specific projects are completed and the details of necessary institutional controls are identified. Once finalized, this plan will function as the Institutional Control Plan and Future Land-Use Plan for the site.

The FCAB issued recommendations regarding future use of the FEMP property in March 1996. The Task Force recommended that the area of the FEMP containing the disposal facility and associated buffer zone remain under the continued ownership of the federal government. Additionally, the FCAB recommended that the remaining portions of the FEMP property be made available for the uses deemed most beneficial to the surrounding communities. The FCAB encouraged DOE to consult with the local communities to establish their preferences for future use and ownership of these areas of the site.

Consistent with these recommendations, DOE will work with the local communities during remedial design on establishing a final land use and ownership plan for the FEMP property. An institutional control plan, focused on specifying the short-term (i.e., during remedial implementation) and long-term institutional control measures to be applied at the site, will be developed during remedial design to complement this final land use plan. The following key components are identified for institutional controls and monitoring:

- Continuation of access controls at the FEMP, as necessary, during the conduct of remedial actions. Property ownership of the disposal facility and associated buffer areas ~~FEMP~~ will be maintained by the federal government.

D7 ~~• Maintenance of remaining portions of the FEMP property (outside the OSDF area) under federal ownership or control (e.g., deed restrictions) to the extent necessary to ensure the continued protection of human health commensurate with the clean-up levels established by the remedy. If portions of the FEMP property are transferred or sold at any future time, restrictions will be included in the deed, as necessary, and proper notifications will be provided as required by CERCLA.~~

- Maintenance of the OSDF to ensure its long-term performance and the continued protection of human health and the environment.
- Conduct of an environmental monitoring program during and following remedy implementation to assess the short- and long-term effectiveness of remedial actions.
- Provision of an alternate water supply to domestic, agricultural and industrial users relying upon groundwater from the area of the aquifer exhibiting concentrations of contaminants exceeding the FRLs. The alternate water supply will be provided until such time as the area of the aquifer impacting the user is certified to have attained the FRLs.

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